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Patent Application of

Fabrice Vitry

For

MOMENTUM LOCKOUT DETENTED - DAMPENED HINGE

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Priority Application:

This application claims priority of U.S. provisional application number 60/395,536, filed July 12, 2002, in the United States Patent and Trademark Office, and incorporates the disclosure thereof as if presented below in full.

Background of the Invention:

The present invention relates generally to hinge mechanisms with push-pull operation. Particularly, the invention relates to such hinge mechanisms, which may be detented to hold a particular position and may have a dampened movement when subjected to the pull-push operation.

Hinge mechanisms, scissor arms, and latches having push-push operations are known in the art. An example of this type of latch is shown in U.S. Patent No. 4,655,489, issued on April 7, 1987, to Robert H. Bisbing. The latch disclosed in this patent operates by capturing a keeper attached to a door or panel when the keeper is initially pushed into the latch housing. The keeper is released by again pushing the keeper into the housing to disengage the keeper from a catch within the housing, hence the term push-push latch.

Some other hinge mechanisms have gravity operated lockouts. Bako et al., U.S. Patent No. 5,106,132, issued April 21 1992 shows a gravity operated lockout ball

for a suitcase closure device. Wilstermann, U.S. Patent No. 4,906,044, shows a gravity operated lockout ball for an automotive arm rest latch. In each instance the Bako and Wilstermann ball rolls downward under the force of gravity to create a lockout condition. These gravity operated lockout balls prohibit the movement of a hook-ended lever from a keeper. There is no suggestion nor is there consideration given in the prior art for adapting a lockout ball to scissor arm type latch. In fact, scissor arm type latches have a structure, which has not been adapted to a lockout ball operation.

An object of the present invention is to provide and improved hinge mechanism with a smooth opening and closing operation.

A second object of this invention is to provide such improved hinge mechanism with a fixedly controlled open position and a fixedly controlled closed position.

A third object of this invention is to provide such a hinge mechanism with controlled biasing for positive movement once said hinge is moved out of its fixed open or fixed closed position and where this biasing includes resonance vibration absorption.

A further object of this invention is to provide such a hinge mechanism with structural components for ease of assembly, low profile structure, and reliable operation and with quieting materials.

An even further object is to provide a momentum activated lockout when the latch is in the closed position.

Summary of the Invention:

The objects of the present invention are realized in a detented and dampened hinge mechanism with push-pull and pull-push controlled-rate operation. This hinge has

a low profile, scissor-style structure, which is suitable for operating a vehicle glovebox lid, or bin, door pocket or boot side access panel or bin, and the like.

Detent forces assist in holding the closed position and the open position, each of which detent forces, in turn, are overcome by an operator's manual movement of the structure. A momentum sensitive device, such as an anti-gravity ball, operates to block the movement of the hinge from the closed position in the presence of excessive forces created during a predetermined excessive change in vehicle momentum, and other types of acceleration forces (both positive and negative acceleration). These forces may arise during a jarring, shock, of sudden acceleration or sideways deceleration, as experienced in an accident or with erratic driving, or in the case of door pockets, when slamming a door shut.

The hinge has a first elongate arm and elongate second arm, which move relative to one another in the plane of their elongations thereby pivoting in the scissor-like operation with added radial translation motion for the detent functions. A spring biases the scissor arms, and thereby the hinge, to each extreme position. A dampener operates against arm movements in both directions for push-pull and pull-push operation. A cam cooperates with a curvilinear cam path to implement an articulated motion between the first and second arms as they move relative to one another. This articulation compensates for variations in mounting positions for various applications between different glovebox, bin and door pocket designs.

The hinge has its first arm fixedly attachable to a first non-movable structural member, such as a glovebox encasement. It has its second arm, being pivotally connected to the first arm, fixedly attachable to a movable structural member, such as a

glovebox lid or bin, door pocket or boot side access panel or bin. Thereby when the arms are moved relative to one another between the first closed position and the second open position, the two structural members move relative to one another.

The second arm carries the damper mechanism that is fitted or snapped into a cutout of that second arm. The damper can engage a portion of the first arm and thereby create a controlled movement between the first and second arms. This controlled movement is an inhibiting force that acts against any excessive pivoting motion during normal operation.

The damper mechanism includes a pinion gear mounted on the second arm. The pinion gear is connected to a friction clutch or a hydraulic clutch, being in this case a hydraulic clutch surrounded with high viscosity silicone lubricant. Different types of lubricant can be used to obtain the desired controlled motion. This pinion gear operates with its teeth engaging a track or length of teeth mounted on the first arm. This length of teeth forms a curved shaped track, i.e. a "rack" with a depression at the closed position end thereof. This depression assists in the closed position detent function. The pinion rotates and traverses the rack, as the hinge arms move between open and closed positions, it thereby operates against the associated clutch force for controlling the normal opening and closing movements of the associated glovebox lid or bin, door pocket or boot side access panel or bin.

The spring is connected between respective hooks, or alternatively between bosses located on each of the two arms. The connection locations on the arms are selected with respect to the pivot location and the configuration of the arms. The spring force is selected to match the damper, door weight, and other factors which are

considered. The detent function is implemented with concave surfaces incorporated at both ends of the curvilinear cam follower track or path. The cam abuts the end of the cam follower path when the hinge is in the extreme open position, i.e., when rotated or pivoted to this position. The position of the cam in the closed position is given by the height and shore hardness of the vehicle's rubber stops mounted on the fixed element or moving element of the vehicle glovebox unit, door pocket unit or boot side access panel or bin unit, i.e., the lid itself or the frame.

In the door pocket application, the rubber stops are mounted on the door trim and when the pocket closes, it comes in contact with a rubber stop. The rubber stop assures that there is no direct contact between the pocket and the door trim, thus absorbing any noise when slamming the pocket shut, or vibration noise when in the closed position and the vehicle engine is at idle, or when the vehicle is moving.

The hinge of this invention allows for slight variations in the height and softness of the rubber stops, and for the possible distortion of in the bins or lids. The hinge adjusts to ensure that its cam member can always travel further down its cam follower track or path. The hinge also, if required, can compensate for these variations and can compensate to keep a preload on the glovebox lid or bin, door pocket or boot side access panel or bin, as the installation may be, from forcing the lid or bin to open. Therefore, the specific glovebox lid or bin, door pocket or boot side access panel or bin remains closed until opened by the operator. This ensures that the attached structure always remains closed and are properly shut, and also under vibration or shock pressure, will not rattle or open.

In addition to the preload weight encountered when the structure is in the closed position, the hinge provides a resistance against opening. This arises as the hinge is mounted so that the surface of the cam follower track or path in the closed position area is at a relative 45 degree angle (inclined) to the direction of the opening force. (The closed position area is that region of the track engaged by the pinion gear when the arms are rotated to place the hinge in its closed state.) This establishes a track incline area, which acts as a large detent area.

In this detent area, the rate of radial motion is greater than the rate of pivotal motion (when the hinge opens the first four degrees), and this makes the second arm translate in a perpendicular fashion towards the opening effort direction. This results in a higher opening effort during the first four degrees of rotational motion and defines a detent area rather than a fixed detent point at (or in) the closed position. (A detent point would be at a predetermined point at a specific angle of rotation.)

The resultant detent area renders the hinge more operator friendly (and wear forgiving) as it provides the detent function over a wide band (of angular rotation) thereby establishing a wide band of closed position tolerance. Moreover, with the detent area, small inconsistencies between installations are not as critical. This becomes a factor when two hinges are installed on a single structure, i.e., one on either side.

The strength of the detent area is adjusted by the angle of the cam follower path or track at the closed position. (Strength of the detent area is the force needed to move out of the detent.) The angle for the path is typically 45 degrees to the opening effort direction, but can be lower to reduce the strength (forces required to move the hinge)

and higher than 45 degrees to increase the strength needed (to open the hinge). It is understood that curvilinear path for the gear track follows the path of the cam follower slot, *i.e., guideway or path.*

The second, movable arm can pivot on an open socket formed in its heel end. This socket mates with a boss located near the lower end of the first, fixed arm. This open socket is slightly elongate which permits the second arm to move radially outwardly off of a deep-seated position, when the arm rotates from the closed position. This permits the articulation motion referred to above. The biasing spring position and its spring force operates to seat the elongate socket on its mating boss when the second arm is in the closed position. This is applicable in the absence of rubber stops, when the hinge installation requires that there should be a clearance gap between the lid or bin and the glovebox, or other housing's, mounting frame or door trim. In this case, the second arm moves to the extreme closed position and thereby defines the closed position for the respective lid or bin.

This extreme closed position is also the normal state of the hinge during shipment and prior to installation. In the case where rubber stops are found in an installation, the hinge should be positioned and fixed on the glovebox frame or door trim such that in the closed position the second arm socket falls just short of its mating boss in order to allow the rubber stops to function in dampening the lid or bin force when contacting the respective frame or trim.

A PVC (polyvinyl chloride) sleeve is positioned over a sufficient portion of the spring's body to dampen spring vibration noise when the hinge slams to the open or to the closed position. Known TPE (thermoplastic elastomer) materials are molded into

abutment surfaces for dampening the shock force and noise created at mechanical stop surfaces. Examples of TPE materials may include talc-loaded polypropylene and may include (SEBS) poly-styrene-b-ethylene-co-butylene-b-styrene, or other suitable polymer-bonded materials.

The fixed arm carries a channel in which the anti-gravity ball operates. This ball has a predetermined mass, which permits it to move at a predetermined rate from a non-lockout position at one end of its channel to a lockout position at the other end of its channel, under incurred excessive acceleration forces. The channel angle and the mass of the ball are also affected by the design parameters for the hinge, including the design parameters of the damper structure, the biasing spring and the average weight exerted by the glovebox lid or bin, door pocket or boot side access panel or bin and the weight of the contents inside. The momentum imparted to the ball causes it to travel to the lockout position. Gravity causes the ball to return to the non-lockout position after the acceleration induced momentum force effect subsides. Typically, the channel is oriented at approximately a forty-five degree angle with the non-lockout position being at the bottom.

The channel provides an enclosure to hold the free moving ball. Such enclosure may project beyond the outside wall of the second, movable arm, when a larger sized ball is need. Alternately, when the anti-gravity ball size permits, the channel may be shaped into a wall of the second arm. In either case, an interlock or a stop surface must be engaged on the first, fixed arm. This interlock can be a shaped abutment, or a socket, or another structure into which the ball can roll to thereby be pinned against the

interlock, resulting in the lockout condition. This lockout condition will last for the duration of any excessive acceleration and resultant momentum imparted to the ball.

Brief Description of the Drawings:

The features, advantages and operation of the present invention will become readily apparent and further understood from a reading of the following detailed description of the invention with the accompanying drawings, in which like numeral refer to like elements, in which:

Fig. 1 is frontal view of the assembled hinge mechanism of the present invention showing in the closed position with the first/ fixed arm in the background and the second moveable arm in the foreground;

Fig. 2 is a reverse or back view of the closed hinge mechanism of Fig. 1;

Fig. 3 is a frontal view of the hinge of Fig. 1 in the locked-out position;

Fig. 4 is a back view of the locked-out hinge of Fig. 3;

Fig. 5 is a frontal view of the hinge of Fig. 1 in the open position;

Fig. 6 is a back view of the open hinge of Fig. 5;

Fig. 7 shows a back/ outside view of the first/ fixed arm of the hinge mechanism of Fig. 2;

Fig. 8 shows the juxtaposed/ inside face of the fixed arm of Fig. 7;

Fig. 9 shows the frontal/ outside face of the movable arm of the hinge mechanism of Fig. 1;

Fig. 10 shows the juxtaposed/ inside face of the movable arm of Fig. 9;

Fig. 11 is a perspective view seen from the left of the inside face of the fixed arm of Fig. 8;

Fig. 12 is a right perspective view of the inside face of the fixed arm of Fig. showing the lockout ball in the non-lockout location;

Fig. 13a is a left perspective view of the inside face of the movable arm of Fig. 10;

Fig. 13b is a left perspective view of the movable arm of Fig. 13a with the damper pinion gear installed;

Fig 14a is a right perspective view of the movable arm of Fig. 13a;

Fig. 14b is a left perspective view of the damper installed movable arm of 13b;

Fig. 15 shows a partial detail view of the movable arm overlaying the fixed arm carrying lockout ball in the non-impact state, non-lockout position for the hinge closed;

Fig. 16 shows a view of the partial structure of Fig. 15 with the lockout ball in the lockout position after impact or acceleration for the hinge locked;

Fig. 17 shows a view of the partial structure of Fig. 15 with the lockout ball in the non-locked position and the hinge opening;

Fig. 18 shows a view of the partial structure and ball position of Fig. 17 with the hinge fully opened;

Fig. 19 is a partial detail view of the inside face of the fixed arm of Fig. 12 showing soft touch materials;

Fig. 20 is a partial detail view of the fixed arm and ball of Fig. 19 with a partial cut-away view of the movable mounted thereon;

Fig. 21 shows the inside face of the movable arm of Fig. 10 with the ball superimposed for its mating abutted position with the hinge fully open;

Fig. 22 shows the movable arm and abutted ball of Fig. 21 with the hinge in the closed position;

Fig. 23 shows the movable arm and abutted ball of Fig. 21 with the hinge immediately after impact or acceleration;

Fig. 24 shows the movable arm and abutted ball of Fig. 21 with the hinge in the fully locked-out closed position;

Fig. 25 shows a partial detain of the moving arm as it abuts the fixed arm boss in the fully opened hinge position;

Fig. 26 shows a partial perspective detail view of the movable arm below the fixed arm about to leave the detent area on the damper track;

Fig. 27 shows the back view of the assembled hinge of Fig. 2 illustrating movement from the closed detent area position; and

Fig. 28 shows the back view the assembled hinge of Fig. 27 illustrating movement at a position midway long the damper track, in between closed and open positions.

Detailed Description of the Invention:

The present invention provides a motion lockout, detented and dampened hinge mechanism. A shock or acceleration (being a positive or negative acceleration), can cause a lockout member to prohibit the hinge from opening from its closed position. The hinge has a low profile scissor configuration having two arms, which are spring

biased to the closed hinge position. Mechanical detents are utilized at either end of the scissoring operation to detent both the closed and the open positions. Soft materials are used to dampen spring vibration noise. Soft materials are also used a abutment locations to dampen abutment noises.

The scissor hinge mechanism 11, shown in a front view in the closed position, Fig. 1, includes a first/ fixed arm 13 and a second/ movable arm 15 mounted for rotation thereon. The first/ fixed arm 13 carries three mounting bosses 17, 19, 21 for mounting the fixed arm to a fixed bin or pocket or glovebox compartment structure, or the like with mounting screws. The first mounting boss 17 is situated at the upper most area of the fixed arm at, what will be further described below as, the open position location of the fixed arm 13. The second mounting boss 19 is located at the closed position location of the fixed arm 13, while the third mounting boss 21 is located at the bottom of the fixed arm 13. These bosses 17, 19, 21, each have an upstanding cylindrical wall 23, extending outwardly from the juxtaposed/ inside face of the fixed arm 13 a distance above the mounting screw head, seating surface. For the first and second bosses 17, 19, the cylindrical wall will present and abutment for the extreme end of rotational motion of the movable arm 15.

The movable arm carries a damper structure, which includes a friction clutch or hydraulic clutch surrounded by high viscosity silicone lubricant. The damper has a pinion gear (described below), Fig. 2, which operates in conjunction with a toothed track or rack 29, Fig. 1. Fig. 2 is shows the hinge mechanism closed from a back view. A projecting back flange Figs. 1, 2, provides an interlock structure for holding the movable

arm 15 on the fixed arm 13, when this projecting back flange is overlapped by a projecting lip 33, Fig. 2, on the back cover 35 of the damper structure 25.

Both the fixed arm 13 and the movable arm 15 are irregularly, elongate shaped. The movable arm 15 is mounted to rotate on the fixed arm from its bottom or heel portion. The hinge 11 is generally mounted so that the two arm 13, 15 elongations extend essentially vertically. The outward end 39 (opposite the heel 37) of the movable arm 15 has a fork structure 41, which creates and open ended elongate slot 43. This slot 43 receives a pin or post mounted to a movable member, such as a lid, bin, door pocket, access panel or bin and the like. As the movable arm 15 moves, the movable member is moved. The slot 43 is sided (surrounded) by a depression surface 45, which is the seating surface for the head of the movable member's post.

The damper structure 25 is located at the outward end 39 of the movable arm 15, adjacent the elongate slot 43. This damper structure 25 snaps into a receiving hole in the movable arm and is held in place by diametrically positioned compression fingers 47.

Positioned at the outward end of the fixed arm 13 is a curvilinear shaped cam follower path or cam slot 49, Fig. 1,2. A solid cylindrical projection 51 extending outwardly from the juxtaposed/ inside face of the movable arm 15 acts as the cam 51 and extends through the cam slot 49. A coil spring 53 mounts between an intermediate location on the movable arm 15 where an attachment, such as the first hook 55, is located, and a projecting lower leg 57 of the fixed arm 13, where a second hook 59 is located. The coil spring 53 carries a cylindrical PVC sleeve 61 the majority of its un-

extended length. This PVC sleeve absorbs spring vibration noise when the hinge 11 is slammed open or closed.

The open position end of the cam slot 49 has transversely extending upper and lower concave pushouts 63, 65. The upper pushout 63 permits ease of assembly of the movable arm 15 on the fixed arm 13. The lower pushout 65 acts as an open position detent. The depth of this lower pushout 65 and the extended spring 53 force determine the open position detent strength.

The heel end 37 of the movable arm 15 is fork shaped with an elongate slot 67. An outwardly extending journal 69 on the juxtaposed/ inside face of the fixed arm 13 acts as the pivot for the rotation of the movable arm 15. This journal 69 has a pair of diametrically opposed, transversely extending lobes 71, 73 at its outer end. The first lobe 71 points away from the first hook 55 location and is used to overlap the right fork arm 75 of the heel 37 when the movable arm 15 is in the extreme open position. The second lobe 73 points towards the first hook 55 location and is used to overlap the left fork arm 77 when the movable arm 15 is in the extreme closed position. Both the right and left fork arms have undercut surfaces 79, 81, Fig. 3, with the right fork undercut 79 extending under the first lobe 71 and the left fork undercut 81 extending under the second lobe 73.

The lockout member is a metal ball 83 discussed further below, and hidden (not shown) in Figs. 1-3. A soft touch bumper 85 is positioned at the movable arm 15 contact point on the first mounting boss 17, Fig. 3. Figs. 3-4 also show the lockout position, i.e., the anti-gravity lock, of the hinge 11, with Fig. 3 being a front view and Fig.4 being a back view. This lockout position "A" is established at a rotation of about 4

degrees from the fully closed position "B". How this lockout position "A" is determined is discussed below.

In Figs. 5-6, which show the hinge 11 mechanism in the open and the closed positions respectively, the movable arm 15 has moved to the fully open position "C" to abut the TPE soft touch bumper 85 on the cylindrical wall 19 of the first mounting boss 17.

When the hinge 11 is in the fully open position "C" the spring 53 is fully extended and the movable arm 15 has moved radially outward 87 following the cam slot 49 shape. In the fully closed position "A" the movable arm 15 seats completely down on the journal 69 as seen in Fig. 1. As the movable arm 15 begins to rotate from the fully closed position, it also begins to articulate, i.e., to move radially outwardly as can be seen in Fig. 2. The fully open position "C" shows the hinge fully opened and the movable arm fully rotated and fully extended outward in the radial direction 87, Fig. 3. This articulation is a design consideration for operating variety of gloveboxes, door pockets, boot access panels/ bins, and the like.

Figs. 7, 8 show the outside face and inside face, respectfully, of the fixed arm 13. The shape of the curvilinear cam slot 49 is easily seen. The closed position "A" end of the cam slot 49 dips downward to form an inclined region 89 of the bottom cam slot edge. This downward projecting region 91 and the inclined region 89 of the bottom cam slot edge provide a detent function at the closed position "A" and the area of rotation immediately adjacent the closed position "A". The length of this detent area is a design consideration in the force used in the opening operation of the hinge 11. The

toothed track, rack 29 dips downward for a parallel region 93 to follow the dip 91 in the cam slot 49.

A closed ended channel 95 for holding the ball 83 is positioned in the juxtaposed/ inside face of the fixed arm 11, Fig. 8. This channel has TPE soft touch bumpers 85 at each closed end. The channel 95 permits the ball 83 to roll between a first position "D" and a second position "E", with the "D" position being the non-lockout position and the second position "E" being the lockout position. The sidewalls of the channel 95 can have any shape, which will permit the ball 83 to freely roll between positions "D" and "E". However, if the sidewalls of the channel 95 are rounded to provide a "neater fit" with the ball and reduce side play, the operation of the ball in the channel will be less noisy and without significant rattling.

The journal 69, Fig. 8, upon which the heel 37 end of the movable arm 15 rotates has its two lobes 71, 73 being pie-shaped or fan-shaped. The first lobe 71 has an upstanding wall 97 which rises from the surface of the inside face of the movable arm 15 at the edge of the lobe 71 closest to third mounting boss 21. This upstanding wall 97 is an additional abutment for the end of the right fork arm 75 at the heel end of the movable arm 15 when that arm 15 is in the fully open position "C". The second hook 59, in the projecting lower arm 57, is formed as an upstanding projection from the inside face of the fixed arm 13.

A spacer block 99 is at the lockout end "E" of the channel near the side facing the cam follower slot 49. This first spacer block 99 acts as a spacer to assure that the two arms 13, 15 are sufficiently separated to allow the free operation of the ball 83. A

concave cutout 101 in this first spacer block 99 abuts the channel and is a size and shape to receive the ball 83 in the lockout position "E".

Figs. 9-10 show the outside face and inside face, respectively, of the movable arm 15, respectively. Referring to the outside face, Fig. 9, the undercut section 45 forming the depressed surface is easily understood. The tab-like shapes of the respective right and left undercut surfaces 79, 81, in the right and left fork arms 77, 79 at the heel end of the movable arm 15 are easily seen to be a size and shape to match the first and second lobes 71, 73 of the fixed arm's 13 journal 69. The right undercut 79 is essentially shovel shaped, while the left undercut 81 has a projecting tang at its base. The spring 53 attachment first hook 55, on the movable arm 15, Fig. 9, projects outwardly from the outside face at an undercut area 99. This spring undercut area 103 permits the spring 53 to be positioned in a lower profile at a plane about where the inside faces of each arm 13, 15 abut. This aligns the spring 53 force with the scissor plane and eliminates binding of the arms 13, 15.

Buildup shoulders 105, 107 surround the elongate slot, Fig. 10, at the fork 41 end of the movable arm 15. These shoulders assure the resultant thickness of the fork 41 and compensate for the undercut 45. Therefore the arm 15 is not weakened in the fork 41 area and will not break in operation. Compensating buildup shoulders 109, 111 also surround the heel slot 67 and provide thickness to compensate for the undercuts 79, 81, respectively.

An irregular but truncated trapezoidal-like shaped undercut area 113 is positioned to extend towards the damper 25 end of the arm 15 from the bottom of the heel slot 67. This undercut provides the spacing for the operation of the ball 83 in the

channel 95 and the pivoting of the arms 13, 15 without binding against the ball 83. A dimpled pad 115 operates as a second spacer block 115 for assuring the spacing between the arms 13, 15 for the free operation of the lockout ball 83. A concave cutout 117 is of a size and shape to receive the ball 83. This second cutout 117 faces away from the heel slot 67 and acts to abut the ball 83 in the lockout position "E" and pin it against the cutout 101 in the spacer block 99 when the hinge 11 is locked out in the closes position.

Figs. 11 and 12 are left and right perspective views, respectively, of the inside face of the fixed arm 13, and further illustrate the shapes of the elements above-described. The steel ball 83 is shown in filled-in (black) is positioned at the lower, non-lockout location, in the channel 95, Fig. 12.

Figs. 13a, 13b, show a left perspective view of the moving arm15 inside face, without the damper gear 27 installed, and with the damper gear 27 installed, respectively. Figs. 14a, 14b show a right perspective view of the moving arm15 inside face, without the damper gear 27 installed, and with the damper gear 27 installed, respectively.

Figs. 15-18 illustrate a partial detail view of the operation of the antigravity ball 83 and the movable arm 15 (foreground) and fixed arm 13 (background). Partial dashed lines are shown as "fine" lines. The antigravity ball 83 is normally free to move up and down the channel 95 freely when the hinge is closed, Fig. 15. Under no acceleration, the ball 83 stays in the lower channel 95 area "D" due to its own weight, Fig. 15. The spring 53 holds the movable arm 15 in the closed position.

Under an impact or acceleration, Fig 16, the ball 83 moves in the direction of acceleration due to the momentum imparted to it. As the ball 83 is designed to have a lower inertia than the movable arm 15 connected to the damper 25 and acting against the spring 53 force, it arrives in the lockout position "E" up the channel before the movable arm 15. The arm 15 then starts to move but is stopped by the ball being in between the two arms 13, 15. In this state the ball 83 becomes cradled between the curved pockets 101, 117 in the bumper/ spacer shoulders 99, 115, respectively. These pockets 101, 117 are shown in later figures.

The hinge 11 can open, Fig. 17, under a no impact and no acceleration condition. Here the ball 83 remains in the lower channel, non-lockout location "D" under its own weight. There is no interference with the arms 13, 15. Therefore, when an operator opens the glovebox to which the hinge is connected, the operation of the hinge members 13, 15 continues because the ball 83 remains in the non-interference location "D". The arms 13, 15 do not lock and the hinge mechanism 11 can open with a low effort.

When the hinge 11 is fully opened, and without acceleration or shock, Fig. 18, the ball 83 remains in the lower channel 95, non-lockout position "D". The arms 13, 15 are free to scissor rotate with respect to one another.

Figs. 19-20 illustrate the use of the TPE soft touch materials 83, over-moulded onto the fixed arm 13 to quiet the antigravity ball 83 operation. These materials 83 at either end of the channel 95 dampen the ball clicking noise when it hits either end. Fig. 20 illustrates the lockout position of the ball 83 against the spacer block 99 and the concave cutouts 101, 117. As previously stated, because of the inertial design the ball

83 arrives at the lockout location between the cutouts 101, 117 before the arms 13, 15 rotate beyond that point, thereby causing a lockout.

Figs. 21-24 illustrate the position of the antigravity ball 83 with respect to the undercut trapezoidal-like undercut area 113, the second spacer block 115 and its concave cutout 117. Fig. 21 shows the position of the ball 83 against a far shoulder of the undercut area 113 of the movable arm 15, when there is no impact, acceleration or shock, and the weight of the ball has it in its lowest position in the channel 95. The hinge 11 is open.

Fig. 22 shows the hinge 11 closed and there is no impact with the ball 83 at its lowest position in the channel 95. Here the ball 83 is mid-way across the undercut area 1131.

Fig. 23 illustrates the ball 83 position after a shock or impact drives the ball 83 up the channel 95, wherein the ball 83 moves faster than the movable arm 15 can react to the shock or impact. Here the ball 83 is about in contact with the concave cutout surface 117 in the second spacer/ bumper block 115. A fraction of a second later the moving arm 15, Fig. 24 comes into contact with the ball 83 and seats it against the concave cutout 117 when the mating concave cutout 101 in the first block 99 on the fixed arm 13 cradles the ball 83 thereby stopping all motion between the arms 13, 15 at about four degrees of rotation out of the closed position "A".

Fig. 25 illustrates a detail of the soft touch TPE material 85 absorbing the mechanical shock as the moving arm 15 abuts the cylindrical surface 23 at the first mounting boss 17 in the fully open hinge position "C", shown in Fig. 26.

Fig. 26 illustrates the movement of the detent 25 out of the detent area between positions "A" and "B". When the hinge 11 is in the closed position, shown in Fig. 27, the opening effort is in a direction always perpendicular to the fork 41 of the moving arm 15. This fork 41 drives the pin connection 119, with the pin 119 attached to the structure to be moved free to move up and down the fork elongate slot 43, Fig. 28. The movable arm 15 movement direction is generally at 45 degrees to the opening effort direction. This assists create the detent effect at the closed position "A" and the length of the incline defines a "detent area". This area is defined by the incline region 89 of the cam slot, seen in Fig.s 26 - 28 and in Fig. 7 where it carries its identification numeral.

If the relative angle is decreased to less than 45 degrees, the detent strength is reduced. The detent strength is foremost established by the angle of the incline region 89 which the cam 51 has to climb against the weight of the moveable arm 15 and the spring 53 force. As the angle increases the detent strength increases. Above about 80 degrees there is a "blockage threshold", i.e., the detent strength is too excessive for vehicle installations. Once the pinion gear 27 of the damper structure 25 clears the "detent area" upon the hinge 11 opening, the resistance reduces and the further opening effort needed is greatly reduced, Fig. 28.

Many changes can be made in the above-described invention without departing from the intent and scope thereof. It is therefore intended that the above description be read in the illustrative sense and not in the limiting sense. Substitutions and changes can be made without departing from the scope and intent of the invention.